Accuracy of ECG lead placement by UK paramedics

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BACKGROUND: The use of the 12-lead ECG is common in UK paramedic practice but its value depends upon accurate placement of the ECG-electrodes. Several studies have shown widespread variation in the placement of chest electrodes by other health professionals but no studies have addressed the accuracy of paramedics.

AIM: The main aim of this study was to ascertain the accuracy of the chest lead placements by registered paramedics.

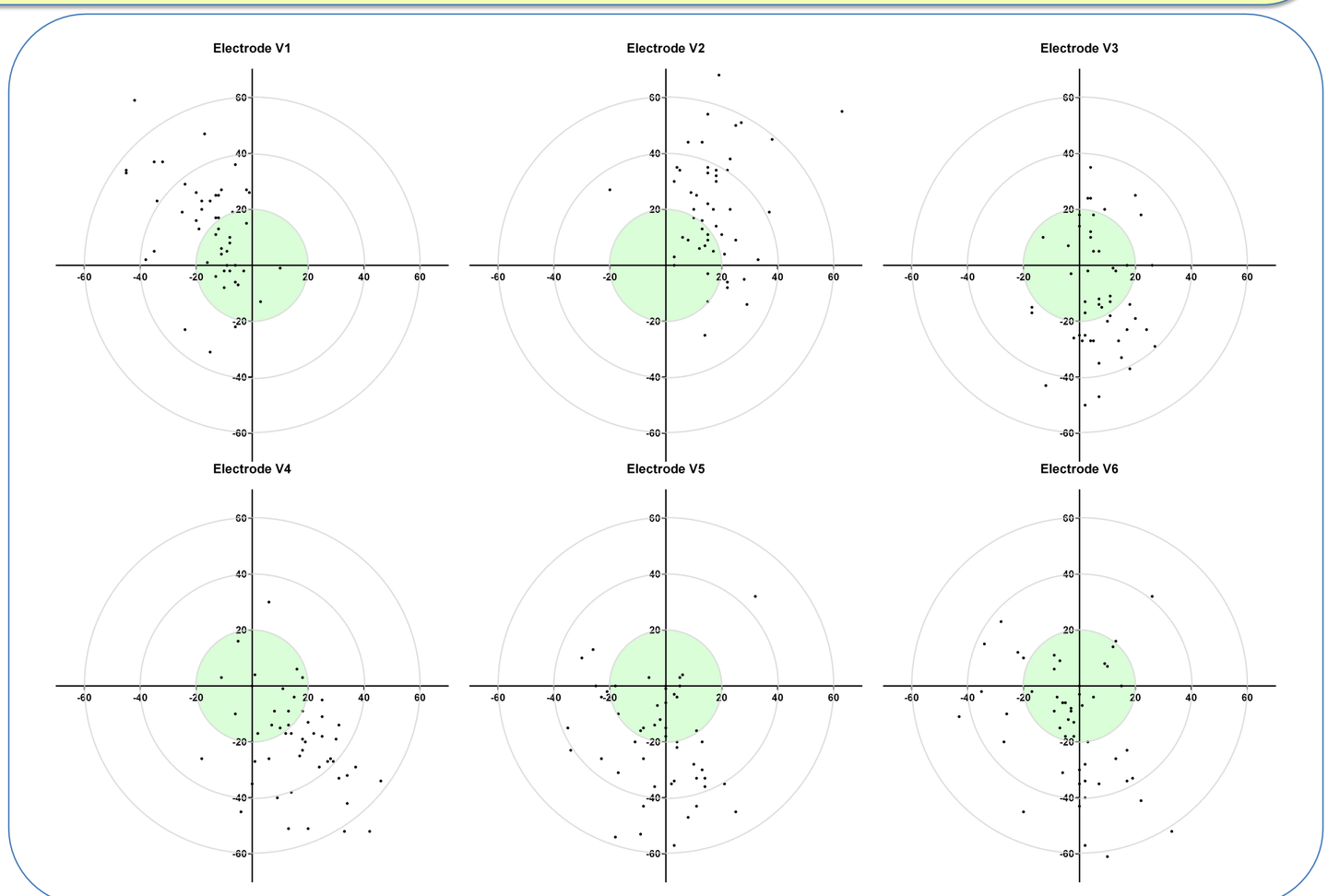
Method: Registered paramedics who attended the Emergency Services Show in Birmingham in September 2018 were invited to participate in this observational study. Professional demographic data were collected prior to completion of the study. Participants were asked to place the chest electrodes on a male model in accordance with their current practice. Placement was measured against reference points that had been pre-determined by two paramedics and an advanced clinical practitioner in accordance with the Society for Cardiological Science & Technology's 2017 Clinical Guidelines for recording a standard 12-lead electrocardiogram. [1] A tolerance of 19mm from optimal positioning was considered to be acceptable for this study. **Note: Only the lead placement results are presented here**

Rationale for 19mm tolerance

- "ECG morphology changes were prominent in all shape parameters beyond 2 cm distance to precordial leads."[2]
- "Misplaced ECG electrodes have the possibility to produce incorrect ECG patterns"[3]

Participants

- 52 eligible participants
- 62% had between 1 & 4 years of operational experience as a paramedic
- Over 86% were current in practice at the time of the study.
- The route to first registration was mainly via higher education; 43 (82.7%) had a FdSc, DipHE, or BSc/BSc (Hons) in a paramedic subject.
- Four (7.7%) held a higher degree in clinical practice.



Key: - Within 20mm accuracy - Outside 20mm Accuracy

	V1	V2	V3	V4	V5	V6
Most superior	59	68	35	30	32	32
Most inferior	-31	-25	-50	-52	-57	-61
Range	90	93	85	82	55	67
Mean vertical (craniocaudal) position	12.66 95%CI [7.46, 17.86]	19.60 95%CI [13.98,25.23]	-8.50 95%CI [-14.24, -2.77]	-19.98 95%CI [-24.76, -15.19]	-17.80 95%CI [-23.11, -12.49]	-13.37 95%CI –[19.38, -7.36]
Most lateral	10	63	27	46	32	33
Most medial	-45	-20	-17	-18	-35	-43
Range	55	60	44	64	67	76
Mean horizontal (mediolateral) position	-15.47 95%CI [-18.84, -12.09]	17.24 95%CI [14.33, 20.17]	7.13 95%CI [4.35, 9.92]	15.72 95%CI [11.83, 19.61]	-3.13 95%CI [-7.35, 1.08]	-2.29 95%CI [-6.75, 2.16]

Table: Range of electrode placements from pre-determined reference point (mm)

Key findings

- First study of its kind to explore the accuracy of chest lead placement by UK registered paramedics
- There was a wide variation in placement of chest electrodes when compared with the pre-determined reference points
- Only 3 participants placed all leads within the 19mm tolerance of the reference points
- Results are similar to studies involving other healthcare professionals

References

1. Campbell B, Richley D, Ross C, Eggett CJ. Clinical Guidelines by Consensus: Recording a standard 12-lead electrocardiogram. An approved method by the Society for Cardiological Science and Technology (SCST) 2017. Available at: http://www.scst.org.uk/resources/SCST_ECG_Recording_Guidelines_2017 (accessed 31/07/2018)
2. Kania M, Rix H, Fereniec M, et al. The effect of precordial lead displacement on ECG morphology. Med Biol Eng Comput. 2014;52: 109–119.
3. Walsh, B. (2018). Misplacing V1 and V2 can have clinical consequences. *The American Journal of Emergency Medicine*, 36(5), pp.865-870.

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